

## THE TRACHEA OF THE HOODED MERGANSER

INCLUDING A COMPARISON WITH THE TRACHEAE OF CERTAIN OTHER  
MERGANSERS

BY ELIZABETH B. BEARD<sup>1</sup>

**A**MONG the many gaps in our knowledge of the Anatidae, as pointed out by Delacour and Mayr (1945: 34), are those regarding the tracheae of certain species. The following description of the trachea of the Hooded Merganser (*Lophodytes cucullatus*) will supplement both the first account written by William MacGillivray (1852: 227) and a later brief account by John C. Phillips (1926: 249).

Prepared, unstretched adult male Hooded Merganser tracheae used in this study had an overall length (including the tympanum) of 102 to 138 mm. This wide variation is at least partly the result of using both alcoholic and dried specimens for measurement. A dried trachea is shorter. (This is very likely because of shrinkage caused by the disappearance of the membrane between the osseous rings.) Even when measuring fresh material, a variation in results is possible. For example, one fresh female trachea when relaxed measured 110 mm., but when stretched to its fullest measured 155 mm. However, measurements of the bony part of the structure are not affected by this shrinkage and consequently show only slight variation. Furthermore, it is to be remembered that discrepancies in total length measurements found in the literature may be the result of age differences; of the condition of the specimen—whether fresh, alcoholic, or dry; and/or of differences in measuring technique (i.e., overall length measurements may have been based on either a fully extended or a contracted trachea).

For about three-quarters of its length the diameter of the tube in the male Hooded Merganser varies little from  $\frac{3}{16}$  of an inch (5 mm.). At the commencement of its lower quarter it flattens and dilates to a width of about  $\frac{1}{2}$  inch (12 mm.). Joined to this enlargement by a short length of tube is an asymmetrical, irregularly-shaped tympanum, a hollow, bony structure about as wide as long, possessing two openings on the ventral and one on the dorsal side, each covered by a tight membrane. The major protuberance (or chamber) is on the left side. Two bronchi arise from the posterodorsal edge.

The tracheal rings are of several kinds. Most of those in the upper third of the tube are complete and nearly uniform in width. All are of osseous tissue and have little membrane between them. Those of the middle third also are bony; some are complete, but most of them are tapered at the ends, and by a

<sup>1</sup> The writer is greatly indebted to F. H. Kortright, E. B. Chamberlain, Jr., Philip Humphrey, and the Royal Ontario Museum of Zoology for furnishing the material on which this description is based.

regular staggered arrangement produce an interlocking or shingled effect. There is very little membrane between these rings. The rings of the dilated, lower third of the tube are tapered, staggered, and quite variable in width. They are osseous on the ventral side but completely membranous on the dorsal side. The approximately ten bony rings which connect the enlarged portion of the tube with the tympanum are of peculiar structure. On the dorsal side they are flat and somewhat tapered in width. On the ventral side, each ring becomes extremely narrow and rises to a small peak in the center. The 'peaks' of eight of the ten rings form an acute midline carina. Membrane separates each of these narrow rings ventrally.

Table 1 presents data on the tracheae of four male Hooded Mergansers.

The measurements of the tracheae of female Hooded Mergansers were from

TABLE 1

TRACHEAL MEASUREMENTS IN MILLIMETERS OF FOUR MALE HOODED MERGANSERS

	1 (dried)	2 (dried)	3 (alcoholic)	4 (alcoholic)
Overall length, dorsal, from posterior edge of glottis to posterior edge of tympanum	—	89	98	124
Overall length, ventral, from posterior edge of glottis to posterior edge of tympanum	—	102	109	138
Diameter at base of glottis	6	6	6	6
Diameter at narrowest part of tube	4	4	4	4
Diameter at beginning of dilation	6	5	5	6
Diameter between dilation and tympanum	6	5	5	6
Length of dilation	13	13	13	13
Greatest width of dilation	12	11	12	12
Length of tympanum, dorsal	10	9	9	10
Length of tympanum, ventral	22	21	21	21
Greatest width of tympanum	19	20	20	20
Length of bronchi	10	—	13	24
Diameter of bronchi at base	4	—	3	4

TABLE 2

TRACHEAL MEASUREMENTS IN MILLIMETERS OF THREE FEMALE HOODED MERGANSERS

	1 (dried)	2 (dried)	3 (fresh)
Overall length from posterior edge of glottis to posterior edge of simple tympanum	—	107	110
Diameter of tube	5	5	5
Greatest width of simple tympanum	8	8	8
Narrowest width of simple tympanum	5	5	5
Length of simple tympanum	5	5	5
Length of bronchi	13	13	13
Diameter of bronchi at base	3	3	3

one fresh and two dried specimens (Table 2). The overall length of the trachea of a female Hooded Merganser is between  $4\frac{1}{4}$  (107 mm.) and  $4\frac{3}{8}$  inches (110 mm.). The tube is nearly uniform in diameter, averaging  $\frac{3}{16}$  of an inch (5 mm.). The tympanum is a simple, symmetrical, hollow structure, roughly trapezoidal in shape, about  $\frac{3}{16}$  of an inch (5 mm.) in length, and formed by fusion of the tracheal rings. Two bronchi arise from its posterior aspect. The tracheal rings are osseous and are quite uniform in size and shape, showing little tapering.

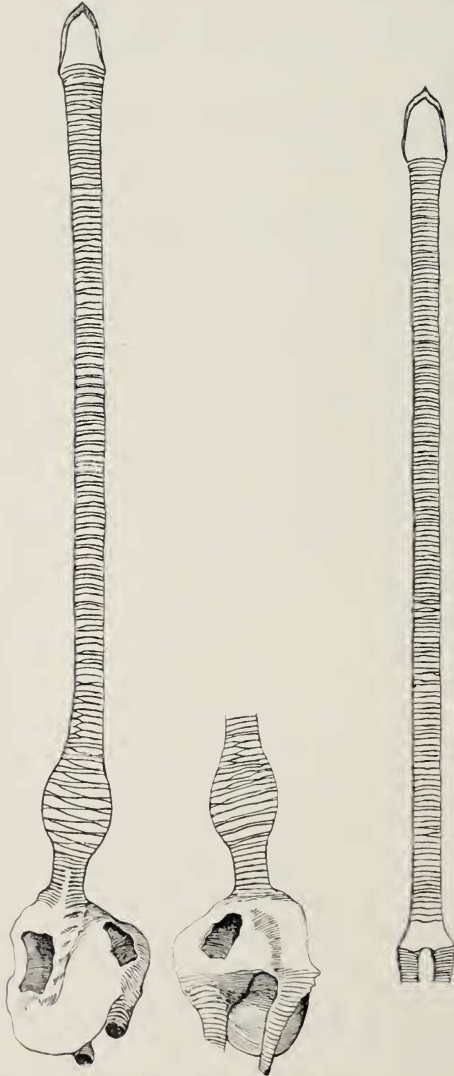


FIG. 1. Left, trachea of adult male Hooded Merganser, ventral aspect, showing tympanum at bottom. Middle, the tympanum, dorsal aspect. Right, trachea of adult female Hooded Merganser, ventral aspect. All drawings a little under natural size.

As an aid toward better understanding of the relationship of the monotypic genus *Lophodytes* to the two other genera of Mergansers (*Mergellus* and *Mergus*), a comparative review of the tracheae of *Lophodytes cucullatus*, *Mergellus albellus*, *Mergus merganser americanus*, and *Mergus serrator* is herewith presented. Measurements for these species (with the exception of the Hooded Merganser) were obtained from published accounts and/or published natural-sized drawings.

Male American Merganser (*Mergus merganser americanus*).—In the male American Merganser the trachea is  $10\frac{1}{2}$  inches long (Audubon, 1838: 270), 12 inches long (Yarrell, 1843: 296), or “about a foot in length, when moderately extended” (MacGillivray, 1852: 209). It is, therefore, from five to eight inches longer than in *Lophodytes cucullatus*. In the American Merganser, the tracheal tube possesses two rounded enlargements, the first (maximum width:  $\frac{8}{12}$  of an inch) in the upper third of the tube, and the second (maximum width:  $\frac{7}{12}$  of an inch) in the middle third of the tube. The lower third of the tube is of uniform width, with an average diameter of  $\frac{3}{12}$  of an inch.

The tympana of the two species are similar in structure—both being hollow, bony, of irregular shape, with the major protuberance on the left, and possessing three membrane-covered fenestrae, one dorsal and two ventral. The greatest diameter of the tympanum of the male American Merganser is  $2\frac{1}{6}$  inches, while that of the male Hooded Merganser is  $\frac{1}{6}$  of an inch. The bronchi arise from the posterior edge on the dorsal aspect nearly one inch apart in the American Merganser and about  $\frac{1}{4}$  of an inch apart in the Hooded Merganser.

Female American Merganser.—The trachea of a female American Merganser is 9 inches long, or about  $4\frac{3}{4}$  inches longer than that of the female Hooded Merganser. Both have tracheal tubes of uniform size:  $\frac{1}{3}$  of an inch in the American Merganser and  $\frac{3}{16}$  of an inch in the Hooded Merganser. The simple tympanum formed by fusion of the lower tracheal rings is of similar shape and structure in both species. The bronchi stem from its posterior aspect,  $\frac{5}{12}$  of an inch apart for the American and  $\frac{1}{8}$  of an inch apart for the Hooded Merganser.

Male Red-breasted Merganser (*Mergus serrator*).—The trachea of the male Red-breasted Merganser measures  $11\frac{1}{2}$  inches (Audubon, 1849: 99), or about 11 inches (MacGillivray, 1852: 218); in other words between  $5\frac{1}{2}$  and  $7\frac{1}{2}$  inches longer than that of the male Hooded Merganser. There is one enlargement just above the midpoint of the tracheal tube. This dilation is two inches long and  $\frac{1}{12}$  of an inch wide. The male Hooded Merganser likewise has one dilation in the tube but this is in the lowest quarter of the tube and is  $\frac{1}{2}$  of an inch wide at its widest point and  $\frac{1}{2}$  of an inch long. In each species the diameter of the remaining portion of the tracheal tube is quite constant, being between  $\frac{1}{4}$  and  $\frac{1}{8}$  of an inch wide in the Red-breasted Merganser and  $\frac{3}{16}$  of an inch wide in the Hooded Merganser.

The tympanum of the male Red-breasted Merganser is irregularly heart-shaped and has a maximum diameter of two inches. In the Hooded Merganser

this structure is asymmetrical and has a maximum diameter of  $\frac{1}{16}$  of an inch. According to Latham (1798: 122) and MacGillivray (1852: 218), the tympana of both species have three membrane-covered fenestrae, two ventral and one dorsal; Audubon (1849: 99) mentions but "two lateral membranous spaces." In the Red-breasted Merganser the bronchi arise  $\frac{3}{4}$  of an inch apart on the posterodorsal edge of the tympanum.

Female Red-breasted Merganser.—No exact measurements of the length of the trachea were found, but since Audubon (1849: 99) states that the trachea has 150 rings, the same number as in the female American Merganser (Audubon, 1838: 270), the length is probably similar, i.e., about 9 inches long, or about  $4\frac{3}{4}$  inches longer than that of the female Hooded Merganser. The tracheal tube is nearly uniform in diameter throughout and ends in a very simple symmetrical tympanum from the posterior aspect of which two bronchi arise.

Male Smew (*Mergellus albellus*).—The trachea of the male Smew is about nine inches long (Yarrell, 1843: 281; MacGillivray, 1852: 235) or from  $3\frac{1}{2}$  to 5 inches longer than that of the male Hooded Merganser. The tube is narrow (about  $\frac{3}{16}$  of an inch) at the anterior end, but it gradually increases to a diameter at midpoint of about  $\frac{3}{8}$  of an inch, this being maintained for the rest of its length. There is no dilation.

The tympanum of the male Smew possesses, according to Latham (1798: 124), one round fenestra covered by a drum-like membrane and, on the opposite side, a smooth, oval, hollow bone which is united with the membrane. Yarrell (1843: 281) mentions "spaces in the bone supplied with tympanic membranes." MacGillivray (1852: 235) states that there are "two lateral membranes of which the posterior is largest." The drawing accompanying Bloch's paper (1779, Tab. 18, Fig. 7) seems to show but one opening. The tympanum is displaced to the left and measures  $1\frac{1}{4}$  inches at its widest point and  $\frac{3}{4}$  of an inch long. The bronchi arise about  $\frac{1}{2}$  of an inch apart.

Female Smew.—No information was obtainable regarding the length of the female Smew's trachea, but a life-size drawing of a portion of the trachea (Yarrell, 1843: 281) shows it to be uniform in width, with a diameter of  $\frac{3}{16}$  of an inch, the same as for the female Hooded Merganser. The simple tympanum measures  $\frac{1}{2}$  by  $\frac{3}{16}$  of an inch, that of the female Hooded Merganser  $\frac{5}{16}$  by  $\frac{3}{16}$  of an inch. The bronchi arise  $\frac{3}{8}$  of an inch apart in the Smew.

#### SUMMARY

The trachea of the male Hooded Merganser is from  $3\frac{1}{2}$  to 8 inches shorter, and much narrower, than that of the male American Merganser, Red-breasted Merganser, or Smew. It possesses but one dilation, this being in the posterior quarter. The trachea of the male Red-breasted Merganser also has a single dilation, but it is much larger than in the Hooded Merganser and is just anterior to the midpoint of the trachea. In the male American Merganser there

are two dilations. In the male Smew there is none. The tympanum, which is present in the male in all four species discussed, varies in configuration and dimensions. In the Hooded Merganser it differs decidedly in proportions and in the number of fenestrae from that of the Smew; and while somewhat similar in shape and number of openings to those of the American Merganser and the Red-breasted Merganser, it is but half<sup>1</sup> as large.

The trachea of the female Hooded Merganser is shorter and smaller than in the female American Merganser, Red-breasted Merganser and Smew. In all these species, however, the trachea of the female is much the same.

LITERATURE CITED

AUDUBON, JOHN JAMES

1838 Ornithological biography. Vol. 4. Adam Black, Edinburgh.

1849 *Ibid.*, Vol. 5.

BLOCH, M. E.

1779 Ornithologische Rhapsodien. Beschäftigungen der Berlinischen Gesellschaft Naturforschender Freunde. Berlin.

DELACOUR, JEAN, AND ERNST MAYR

1945 The family Anatidae. *Wilson Bulletin*, 57: 3-55.

LATHAM, JOHN

1798 An essay on the tracheae or windpipes of various kinds of birds. *Trans. Linn. Soc. London*, 4: 90-128.

MACGILLIVRAY, WILLIAM

1852 A history of British birds. Vol. 5. London.

PHILLIPS, JOHN C.

1926 A natural history of the ducks. Vol. 4. Houghton Mifflin Co., Boston.

YARRELL, WILLIAM

1827 Observations on the tracheae of birds; with descriptions and representations of several not hitherto figured. *Trans. Linn. Soc. London*, 15: 378-388.

1843 A history of British birds. Vol. 3. London.

UNIVERSITY OF MICHIGAN DEPARTMENT OF WILDLIFE MANAGEMENT, ANN  
ARBOR